It is likely, however, that these studies have underestimated the direct costs of smoking for a variety of reasons (Warner et al. 1999). For example, they ignore other significant economic costs, including the costs of transportation associated with obtaining medical care and the costs of nonmedical care associated with accommodating a person with a smoking-related chronic illness. These estimates also generally fail to account for other medical care costs related to cigarette smoking, such as burn care from injuries in smoking-related fires and perinatal care for low-birth-weight infants of mothers who smoke. Few studies have attempted to include the direct costs for nonsmokers of diseases related to exposure to ETS, and none of these studies has tried to estimate the intangible costs of smoking-related illnesses (i.e., the pain and suffering associated with the illness and the grief experienced by family and friends).

A human capital approach is generally used to estimate the indirect morbidity and mortality costs associated with cigarette smoking. This approach views an individual as producing a stream of output or earnings computed at market value or as the imputed value of housekeeping services. Thus, the value of a person is reflected by his or her earnings, and the lifetime value for that person is equal to the discounted stream of future earnings (Max and Rice 1995). This approach places a relatively high value on morbidity and mortality among young adults, men, and the more educated because of the relatively higher earnings that would be lost by these smokers (Markandya and Pearce 1989); moreover, lost earnings may not be an accurate reflection of the value people place on their health or on their lives. Furthermore, the human capital approach is in contrast to the "willingness-to-pay" approach, which tries to estimate the value a person assigns to reducing his or her risk of premature death.

A more controversial component in the computation of the lifetime costs of smoking concerns the treatment of transfer payments. These transfer payments include the reduction in income taxes and insurance premiums paid by smokers because of reduced earnings associated with smoking-related illnesses, the value of Social Security and private pensions foregone because of smoking-related premature deaths, higher health care costs associated with smoking-related illnesses and paid by public and private insurance plans, and increased sick pay and disability benefits paid during smoking-related illnesses. Particularly objectionable to many people is the idea that foregone Social Security and private pension benefits from smokers who die prematurely from smoking-related illnesses should be considered "benefits" to nonsmokers. As Harris (U.S. House of Representatives 1994) and others have noted, premature deaths are not considered a benefit when policymakers determine what levels of funded research are appropriate for reducing premature deaths from other risk exposures (CSH 1994; Warner et al. 1995, 1999). Nevertheless, several recent estimates of the costs of smoking have considered these foregone benefits in their computations of the economic costs of cigarette smoking (Manning et al. 1989, 1991; Shoven et al. 1989). These studies aim to provide a complete accounting of the costs of smoking to answer the question of whether payments by those who have ever smoked into collectively financed systems such as Medicare and Social Security equal receipts by those who have ever smoked.

Theoretically Optimal Cigarette Taxes

As was just discussed, several estimates of the optimal or fair tax on cigarettes are based on the various studies of the costs of smoking. In the context of the preceding discussion, an optimal tax is one that equates the total revenues from these taxes to the net external costs of cigarette smoking. These estimates have ranged from those implying that current taxes more than cover the external costs of smoking (Manning et al. 1989) to those that have suggested that current taxes are far too low. For example, one such study that included the costs of the long-term intellectual and physical consequences resulting from smoking-related low birth weight among infants born to mothers who smoke indicated that $4.80 was an appropriate tax on a pack of cigarettes (Hay 1991).

Another study (Pigou 1962) advanced a similar notion in providing a theoretical justification for taxes on goods with market prices not fully reflecting the social costs associated with their production and consumption. From that perspective, these taxes could be viewed as improving economic efficiency by raising a smoker's marginal cost of smoking to a level nearer the social marginal cost. For some goods, taxes could generate revenues that exceed total external costs because the taxes would be based on marginal rather than average external costs (Cook and Moore 1993).

Estimates of optimal taxes on cigarettes imply that smokers are fully informed about the risks associated with cigarette smoking (Cordes et al. 1990). If smokers underestimate these risks, then even higher taxes could be appropriate to discourage people from smoking. This issue may be particularly relevant for an addictive product such as cigarettes if, when people take up smoking, they do not fully understand the addictive properties of consumption and the implications of

addiction for future choices. Gruber and Koszegi (2000), for example, concluded that if these "internalities" are taken into account, they suggest sizable additional taxes of one dollar or more per pack of cigarettes.

Among the most widely cited recent estimates of the optimal tax are the studies of the economic costs of cigarette smoking by Manning and colleagues (1989, 1991). These incidence-based estimates used data from the RAND Corporation's Health Insurance Experiment and the 1983 National Health Interview Survey. To calculate the optimal tax on cigarettes, the analyses estimated both the lifetime external costs associated with cigarette smoking and the perceived "savings" that result from smokers' dying earlier and not realizing their pension and Social Security benefits.

Using their midrange estimates, Manning and colleagues (1989, 1991) concluded that for a new smoker, the total external cost of smoking was 43 cents per pack of cigarettes in 1986. This estimate comprised 1 cent in extra costs for sick leave, 2 cents in costs for smoking-related fires, 5 cents in added costs for group life insurance, 9 cents in lost tax revenues (to finance retirement and health benefits), and 26 cents in spending on additional medical care. These costs would be offset, however, by an estimated 27 cents per pack in external savings resulting from smoking-related premature deaths. Converting these figures to 1995 dollars (based on the medical service price index and the gross national product deflator), the CRS estimated a net external cost of 33 cents per pack for cigarettes, which is approximately two-thirds of the average federal, state, and local taxes on cigarettes of 50 cents per pack in late 1993 (Gravelle and Zimmerman 1994). The CRS thus concluded that smokers were more than paying their way.

Critics of the studies of Manning and colleagues (1989, 1991) contend that many of the assumptions made in obtaining the estimates are inappropriate. If the analyses had not included the effects of unrealized pension and Social Security benefits of smokers who die prematurely, the resulting external costs of smoking would have amounted to approximately 89 cents per pack in 1995 dollars.

Moreover, the studies of Manning and colleagues (1989, 1991) made a debatable distinction between internal costs (those borne by the smoker) and external costs (those that smokers impose on nonsmokers). For example, the lost productivity costs described in those analyses were treated as internal costs, whereas only the higher, collectively financed, group premiums for health, life, and other insurance that nonsmokers paid to cover smoking-related costs not reflected in the premiums paid by smokers were considered external costs.

More controversial, however, was these analyses' assumption that the cost of ETS was an internal cost. This assumption was based on the argument that the family is the economic unit involved in making smoking and other decisions and that the health consequences of ETS are largely confined to the nonsmoking spouses of smokers. As Manning and colleagues (1991) note, when this assumption is modified to treat the consequences of passive smoking as external costs, the estimated external costs of smoking rise significantly. For example, under the assumptions of Gravelle and Zimmerman (1994) concerning prices, the estimates of Manning and colleagues (1991) imply that including the relatively conservative estimate of 2,400 lung cancer deaths from ETS would add approximately 31 cents per pack (in 1995 dollars) to the external costs of smoking. Similarly, updating the researchers' estimates of the costs of neonatal care for smoking-related low birth weight would add more than 4 cents per pack. Doing the same for deaths from smoking-related fires would add 20 cents per pack and for smoking-related fetal deaths would add 31 cents per pack.

These estimates probably understate the true costs of ETS. After reviewing the literature on the links between ETS and heart disease, Glantz and Parmley (1995) concluded that 30,000–60,000 persons die prematurely from heart disease related to ETS. Including these numbers in estimates by using the same assumptions used in the CRS report would add at least another 70 cents to the estimate of the optimal tax. Moreover, the CRS report ignored the 150,000–300,000 cases of ETS-linked lower respiratory tract infections in children up to 18 months old and the ETS-linked worsening of asthma in 200,000 to 1 million children (Environmental Protection Agency [EPA] 1992). Including these costs would lead to an even larger optimal tax. Finally, the estimates excluded the long-term developmental consequences suffered by infants with smoking-related low birth weight (Hay 1991); were these costs included, the optimal cigarette tax would be nearly $5 per pack.

Using the human capital approach, Manning and colleagues (1989, 1991) estimated that the life of a nonsmoker who died prematurely from ETS exposure was worth $1.66 million. In a recent cost-benefit evaluation of the proposed Smoke-Free Environment Act of 1993 (introduced in the 103rd Congress but not passed), the EPA (Mudarri 1994) used the willingness-to-pay approach and obtained a $4.8 million baseline estimate of the value of a life. The EPA also used this approach to include the effects of ETS on heart disease and children's health when calculating the value of benefits from reduced ETS exposure.

By using the willingness-to-pay approach and making some relatively conservative assumptions, the EPA estimated that the total benefits from the reduced ETS exposure that would result from a ban on smoking in all worksites was $39–71 billion per year. This estimate assumed that the ban would reduce the number of current smokers by 3–6 percent, the number of future smokers by 5–10 percent, and consumption among continuing smokers by 10–15 percent; the resulting total long-run reduction in consumption would be 14–22 percent. The combined effect of these reductions in smoking and of the creation of designated smoking areas was predicted to reduce out-of-home exposures to ETS by 90 percent and in-home exposures by a midrange estimate of 6 percent. Estimates from the 1992 EPA report on ETS and lung cancer suggested that 73 percent of exposures to ETS occur outside the home and that 27 percent occur in the home. The total reduction in ETS exposure was thus predicted to be 66 percent; if it were applied to estimated total ETS costs of $58.7–106.9 billion, this reduction would yield the EPA's estimated cost benefits of $39–71 billion. Given current cigarette sales of about 24 billion packs per year, this estimate implied that the per pack external costs of ETS were between $2.45 and $4.45. This estimate is likely to be low, because the short-term and long-term costs of fetal and perinatal exposure to ETS were not included in the EPA's computations.

Viscusi (1995), however, reached a much different conclusion in analyzing the social costs of smoking. This investigator updated much of the analysis by Manning and colleagues (1989, 1991), used a willingness-to-pay approach, and included the same ETS risks used in the EPA's analysis (Mudarri 1994). Viscusi, however, argued that the EPA approach overestimated the risks of ETS by failing to account for the change in the tar content of cigarettes and the changes in cigarette consumption per smoker. Noting that the average tar content of cigarettes declined from 46.1 mg per cigarette in 1944 to 12 mg per cigarette in 1994, Viscusi asserted that the health risks associated with cigarette smoking, as well as the risks from exposure to ETS, are linearly related to the tar content of cigarettes. Although presenting no evidence for either assertion, he contended that estimates of the health risks based on consumption of higher-tar cigarettes and exposure to ETS from higher-tar cigarettes need to be adjusted to reflect the decline in tar content. When not adjusting for tar, Viscusi obtained an estimate for the per pack external costs of cigarette smoking well above the average tax on a pack of cigarettes; when adjusting for tar, he concluded that current cigarette taxes exceed the external costs of smoking.

A clear consensus is lacking regarding the optimal tax on cigarettes. Optimal tax calculations from prevalence-based estimates that include the direct and indirect costs of smoking-related morbidity and mortality are likely to be inappropriate, because the calculations include lost productivity and other costs that should arguably be considered internal costs. Similarly, optimal tax calculations from the recent incidence-based estimates probably underestimate the optimal tax, because these calculations exclude many of the external costs of smoking. Nevertheless, because of the growing evidence of the substantial health consequences of exposure to ETS (including fetal and perinatal exposure), a tax that would generate sufficient revenues to cover all external costs from smoking is likely well above the current average of federal, state, and local taxes on cigarettes.

Cigarette Taxes and Health

As the review of studies on cigarette demand demonstrated, increases in cigarette prices lead to substantial reductions in cigarette smoking by deterring smoking initiation among youth, prompting smoking cessation among adults, and reducing the average cigarette consumption among continuing smokers. Because of the substantial health consequences of cigarette smoking and the health benefits of smoking cessation, these reductions in cigarette smoking would lead to significant improvements in health by reducing smoking-related morbidity and mortality. Thus, increases in cigarette excise taxes, which would result in increases in cigarette prices, would be an effective policy tool in improving health.

Several recent studies have provided some estimates of the health benefits resulting from cigarette tax increases. For example, Warner (1986) used published estimates of price elasticity (Lewit et al. 1981; Lewit and Coate 1982) to estimate the impact of higher cigarette excise taxes on smoking and health. The study predicted that a sustained, real 15 percent tax-induced increase in cigarette prices in 1984 (which would have been equivalent to restoring the federal tax to its real value in 1951—a nominal tax of 32 cents per pack) would deter 800,000 young people from smoking and encourage about 2.7 million adults to quit. Using the conservative assumption that one of every four lifelong smokers dies prematurely of a smoking-related illness, the researchers estimated that this tax increase would reduce premature deaths among persons 12 years and older by 860,000.

The GAO (1989) used the same estimates of price elasticity to predict the health benefits from a sustained,

real tax increase of 21 cents per pack in 1989 (which they estimated would raise the price by 15 percent). Using the one-in-four assumptions made by Warner (1986), the analysis estimated that this tax increase would reduce the number of youth who smoke by 500,000 and would subsequently reduce premature deaths from cigarette smoking among youth by 125,000.

Harris (1987) used various estimates of the price elasticity of demand in an analysis of the health implications of the 1983 tax hike and corresponding price increase. The analysis concluded that this tax increase deterred 600,000 young people from smoking. After reviewing the epidemiologic literature, Harris estimated that an additional 54,000 young people and a total of 100,000 people would survive to at least 65 years of age as a result of the tax increase.

Two recent studies directly examined the health benefits of increases in cigarette excise taxes (Moore 1995; Evans and Ringel 1999). Using annual state-level death rates from smoking-related diseases (including heart disease, lung cancer, cardiovascular disease, mouth and throat cancer, and asthma), the study directly estimated, through appropriate econometric methods, the impact of higher taxes on health. The resulting estimates implied that a 10-percent increase in cigarette excise taxes would save approximately 5,200 lives annually. Similarly, Evans and Ringel (1999), using data from the 1989–1992 Natality Detail files, concluded that higher cigarette taxes would significantly improve birth outcomes.

The CSH (1994) analyzed the health benefits of higher cigarette excise taxes by using relatively conservative estimates of the price elasticity of demand and of deaths related to cigarette smoking. The study estimated that, based on 1992 taxes and cigarette smoking data, an increase of 75 cents per pack in the federal cigarette excise would reduce premature deaths by 900,000. The study further estimated that a $2.00 increase would save an additional 1 million lives.

Similarly, Chaloupka (1998) provided estimates of the effects of alternative cigarette tax and price increases contained in various national tobacco settlement proposals based on Chaloupka and Grossman's (1996) econometric analysis of youth smoking. For example, he estimated that a $1.50 increase in cigarette taxes and prices, phased in over a relatively short period of time and then adjusted for inflation, would reduce overall cigarette consumption by approximately 30 percent, while cutting the prevalence of youth smoking nearly in half. Given the CDC's recent estimate that 16,620,878 youth in the 1995 cohort of 0- through 17-year-olds would eventually become smokers and that 32 percent of regular smokers eventually die from a smoking-related disease, Chaloupka (1998) estimated that this tax would prevent approximately 2.5 million premature deaths in this cohort.

The substantial econometric literature clearly indicates that increases in cigarette prices will reduce both smoking prevalence and average cigarette consumption. Because of the well-documented health consequences of smoking, tax-induced increases in cigarette prices would generate substantial improvements in health. Thus, higher taxes on cigarettes and other tobacco products appear appropriate from a public health perspective. In addition, at a gathering convened by the CDC to evaluate the criteria for defining an optimal cigarette tax, economists raised two further reasons for higher cigarette taxes (Warner et al. 1995). First, to the extent that adolescents and young adults do not fully understand the addictive nature of cigarette smoking, the argument could be made that higher cigarette taxes can reduce smoking by youth before it is too late for them to quit easily. Second, to the extent that youth behave more myopically than adults (in particular, more than the adults that they will later be), young people are more likely to take on a habit with long-term health consequences. Thus, by discouraging smoking, the higher tax can help correct youth's myopic behavior.

Although higher cigarette taxes are likely to produce substantial improvements in health, several factors could mitigate the impact of these taxes. First, as the limited research on the demand for smokeless tobacco products suggests (Ohsfeldt and Boyle 1994; Ohsfeldt et al. 1997, 1999), increases in cigarette taxes not matched by similar increases in smokeless tobacco taxes may induce people to substitute other tobacco products with similar health consequences. For example, the large increases in Canada's cigarette excise taxes and the consequent increases in the differential between cigarette taxes and taxes on roll-your-own tobacco led to a sharp rise in the use of the latter (Department of Finance, Canada 1993). This substitution could easily be avoided by increasing all tobacco taxes simultaneously. Canada's experience also raises the issue of equalized taxes between nations, because relatively large tobacco tax hikes resulted in a border-crossing black market in cigarettes and other tobacco products as well as in other efforts to avoid taxes. Alternatively, as Evans and Farrelly (1998) found, the higher taxes may lead smokers to change the kinds of cigarettes they smoke (i.e., they may switch to higher-tar and higher-nicotine cigarettes), thereby reducing the health benefits of higher cigarette taxes. The results of the study by Evans and Farrelly suggest that

taxes based on the tar, nicotine, and carbon monoxide content of cigarettes (first suggested by Harris 1980) may be the most appropriate means to address the public health consequences of smoking.

Of course, cigarettes and other tobacco products are not the only goods that can be taxed on the basis of these arguments. Heavy consumption of alcoholic beverages, for example, also leads to health problems, unintentional injuries, property damage, and other consequences. Cook and Moore (1993) provide a detailed discussion of the rationale for higher alcoholic beverage excise taxes. A number of studies of the "optimal" tax on alcoholic beverages have concluded that current taxes are well below the level that would cover the social costs of alcohol abuse (Manning et al. 1989, 1991; Saffer and Chaloupka 1994).

Tobacco Taxation and Revenues

An alternative rationale for tobacco taxes is that they are a relatively simple way to generate revenues. Even some prominent proponents of the free market philosophy have supported tobacco taxes to generate revenues. "Sugar, rum, and tobacco," wrote Adam Smith in his 1776 economic treatise, *An Inquiry Into the Nature and Causes of the Wealth of Nations*, "are commodities which are no where necessaries of life, which are become objects of almost universal consumption, and which are therefore extremely proper subjects of taxation" (1976, Book V, p. 474).

As described earlier in this chapter (in "Rationales for Tobacco Taxation"), various levels of government have long used cigarette and other tobacco taxes to raise revenues. Such policy is supported by economic theory. An economically efficient way to raise revenues while minimizing the welfare losses associated with the price distortions resulting from taxes is to impose relatively higher taxes on goods with more inelastic demand (one for which the percentage reduction in demand is smaller than the percentage increase in price) (Ramsey 1927). As described earlier in this chapter (in "Effect of Price on Demand for Tobacco Products"), the numerous studies of cigarette demand and the limited studies of the demand for other tobacco products have implied that overall demand, at least in the short run, is inelastic. Thus, large increases in tobacco taxes can generate substantial increases in revenues, particularly in the short run.

Since 1960, the dollar amount of federal revenues generated by tobacco taxes has increased significantly, from $1.9 billion to nearly $5.9 billion in 1997. Over this same period, state revenues from tobacco have also increased significantly in nominal terms, from slightly less than $1 billion to more than $7.5 billion. As new sources of tax revenues have been identified, however, tobacco revenues have constituted a smaller proportion of total revenues. Tobacco taxes accounted for 3.36 percent of all federal revenues in 1950, but they were only 0.44 percent of revenues in 1989 (CBO 1990). Similarly, total federal tobacco tax revenues as a share of the gross national product fell from 0.55 percent in 1950 to 0.08 percent in 1989.

Merriman (1994) considered whether cigarette excise taxes are set to maximize the revenues from these taxes. More specifically, Merriman tested the idea that elected officials, in an effort to maximize their own utility, may increase taxes on some goods to the point where revenues from these taxes begin to decline (Buchanan and Lee 1982). Using published estimates of cigarette demand (Becker et al. 1994), the study found that cigarette excise taxes in every state were well below the revenue-maximizing level of these taxes, at least as of 1985. Furthermore, these estimates of the marginal revenue effects of higher taxes were lower-bound estimates, because they held constant other states' taxes (a consideration that allowed for increases in the casual and organized smuggling of cigarettes in response to a tax hike in a given state). Coordinated state tax increases, as a result, would generate even higher revenues.

Grossman (1993) considered this issue of maximizing the federal excise tax on cigarettes. Using published estimates of cigarette demand (Chaloupka 1991; Becker et al. 1994), Grossman predicted that in the long run, a real federal tax rate of $1.26 would maximize federal tax revenues at $16 billion and would generate even larger immediate increases in revenues. Likewise, Becker and Grossman (1994) suggested that the long-run revenue-maximizing value of the federal cigarette excise tax is 95 cents per pack in 1994 dollars. This tax would generate approximately $12 billion in total revenues and would raise considerably more than in the short run. These estimates were consistent with the prediction that a sustained real increase of 75 cents in the federal tax on cigarettes would in the long run lead to a net increase in cigarette tax revenues of just over $16 billion (Gravelle and Zimmerman 1994).

Other studies, however, have predicted that higher federal taxes would generate much greater revenues (Harris 1994; Womach 1994a). For example, Harris has predicted that raising the federal tax to $2.00 per pack would have generated nearly $20 billion in additional revenues annually, on average, from 1995 through 1999, whereas Chaloupka (1998) estimates that a $1.50 increase would, in the short run, raise $22.5 billion annually.

The differences among the predicted revenue effects of higher cigarette taxes may be attributed to different assumptions used to obtain these estimates as well as to differences in the period for which the predictions are made. For example, two studies (Grossman 1993; Becker and Grossman 1994) have assumed a linear demand function for cigarettes. One of the implications of this function is that the price elasticity of demand rises as price rises. Thus, when the effects of a large increase in the cigarette excise tax are predicted, cigarette demand is assumed to become more responsive to price. This assumption implies that there is an inverted U-shaped relationship between cigarette taxes and revenues: increasing cigarette taxes from relatively low levels will initially lead to increased revenues; beyond some point, further increases in taxes will lead to even larger reductions in demand, thereby causing revenues to fall. The same basic argument is implicit in the well-known Laffer curve, which relates income tax rates to income tax revenues.

The assumption of a linear demand function for cigarettes is in contrast to the assumption made by some other analysts that the price elasticity of demand is constant over the range of prices under consideration. Because almost all of the studies described in this section found that the demand for cigarettes is inelastic, the assumption of a constant elasticity implies that even very large increases in taxes will always generate large increases in revenues.

The differences in revenues predicted by these two assumptions, although only minor when analyses predict the impact of relatively small cigarette tax increases, grow with the size of the tax increase. Because either assumption could be questioned, the revenue effects of a tax increase will likely fall somewhere between the predictions obtained from the two (Grossman et al. 1993). The limited evidence from the behavioral economics literature suggests, however, that the effects of large increases in cigarette prices will lead to larger reductions in cigarette demand than predicted by the assumption of a linear demand function (Bickel et al. 1991).

A second key factor leading to the differences discussed here is the distinction between the short-run and long-run effects of the tax hikes. Economic theory implies that the demand for most consumer goods will be more responsive to price in the long run than in the short run. For cigarettes and other tobacco products, additional factors increase the likelihood that the long-run effects of an increase in price on cigarette demand will exceed the short-run effects—that is, price elasticity will increase in a manner similar to the increase for other, nonaddictive goods and services. Increased cigarette taxes will thus lead to smaller increases in revenues in the long run than in the short run.

That adolescents and young adults are more responsive to prices than older adults are and the fact that cigarette smoking is an addictive behavior are of particular importance when predicting the short-run and long-run revenue effects of higher cigarette taxes. Age difference in price elasticity implies that sustained real tax increases will lead to greater reductions in smoking prevalence and consumption as the number of adolescents and young adults who have not yet decided to smoke replaces the number of older adults who already smoke. The assumption of addiction implies that price has a cumulative effect on consumption: the price increase immediately reduces current consumption by discouraging young people from experimenting or continuing to experiment with smoking, as well as by encouraging current smokers to smoke less; future consumption is then reduced by the continuously fewer current smokers who also continue to smoke less in the face of a sustained real increase in price. The cumulative effect of price on consumption thus exceeds the immediate effect. This sequence ultimately leads to reduced revenues.

In summary, federal and most state excise taxes on cigarettes are undoubtedly well below their revenue-maximizing levels. Thus, relatively large increases in these taxes would lead to substantial gains in revenues, particularly in the short run. Moreover, because of the relatively inelastic demand for cigarettes, increases in cigarette taxes are an economically efficient means of generating substantial revenues while imposing relatively small welfare losses. But if there is little argument that large increases in cigarette taxes would generate substantial increases in tax revenues in the short run, there are some questions on the revenue-maximizing values of these taxes and the long-run stability of revenues generated by large increases in cigarette taxes.

Part of the difficulty in estimating the effects of large taxes on cigarettes is that there is little experience in the United States with relatively large increases. Similarly, it is unlikely that the long-run effects of the more recent large tax increases have been fully played out. The short-term experience in Canada is of limited use in addressing these issues. Cigarette taxes in Canada increased more than 500 percent between 1982 and 1992, which increased real cigarette prices by 170 percent, and total smoking fell by 38 percent (Sweanor and Martial 1994). Because of the effects of other, contemporaneous activities to reduce tobacco use, the impact of the large price increases on smoking were consistent with the estimates from the studies of U.S. cigarette demand

described in this chapter. Moreover, total federal and provincial revenues generated by Canadian cigarette taxes were 240 percent higher in 1992 than in 1981 even with the concomitant considerable black market in cigarettes. This experience suggests that large increases in cigarette taxes in the United States would generate sizable tax revenues for many years.

Conclusions

1. The price of tobacco has an important influence on the demand for tobacco products, particularly among young people.

2. Substantial increases in the excise taxes on cigarettes would have a considerable impact on the prevalence of smoking and, in the long term, reduce the adverse health effects caused by tobacco.

3. Policies that influence the supply of tobacco, particularly those that regulate international commerce, can have important effects on tobacco use.

4. Although employment in the tobacco sector is substantial, the importance of tobacco to the U.S. economy has been overstated. Judicious policies can be joined to higher tobacco taxes and stronger prevention policies to ease economic diversification in tobacco-producing areas.

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Chapter 7
Comprehensive Programs

Introduction

A comprehensive approach to reducing tobacco use recognizes that individual behavioral choices occur in a larger, complex context: a social setting of family, community, and culture; a complex economic and physical environment; formal and informal government policy; and the prevailing legal atmosphere (Green and Richard 1993). The specific programs reviewed in prior chapters can be better understood as part of a general framework for health promotion (World Health Organization [WHO] 1986; *Health Promotion International* 1997). Using such a framework, this chapter will review community-based intervention studies and the current models for comprehensive tobacco prevention and control that are funded by specific excise taxes or by settlements with the tobacco industry.

The evaluation of multicomponent interventions and socioecological models of health promotion poses a special problem (Green and Kreuter 1991; Sanson-Fisher et al. 1996; Nutbeam 1998). The most effective models of health promotion are social movements that evolve (Kickbusch 1989; Allison and Rootman 1996; Downie et al. 1996; Nutbeam 1998). Thus, the nature and complexity of health promotion interventions do not fit the tightly defined, controlled, and presumably reproducible research model that is more suitable for epidemiologic testing (Elder et al. 1993; Mittelmark et al. 1993; Baum 1995; Allison and Rootman 1996; Macdonald et al. 1996; Nutbeam 1996, 1998). Nonetheless, surveillance data, periodic surveys, and other administrative data from multiple sites permit these interventions, as well as "natural experiments," to be studied. Traditionally, per capita consumption data, adult prevalence surveys, and surveys of tobacco-related behaviors among young people have been the core of this surveillance approach. Recently, a broader array of legislative, economic, media, and program data has emerged to enhance surveillance of the social environments that influence the use of tobacco products. For example, the WHO's *Guidelines for Controlling and Monitoring the Tobacco Epidemic* (WHO 1998) provides detailed recommendations on the types of data that should be monitored for both planning and evaluating tobacco control efforts. For the United States, the Centers for Disease Control and Prevention (CDC) has published background information on sources of national surveillance data (Giovino et al. 1994). The Federal Trade Commission provides annual estimates of trends in the tobacco industry's advertising and promotion expenditures. Surveillance data on protobacco influences are not well monitored, however, particularly at the state level. Finally, Wakefield and Chaloupka (1999) have provided a conceptual framework for the monitoring of comprehensive tobacco control programs, particularly those that focus on preventing teenage smoking.

Conceptual Frameworks

From its formation in the mid-1970s, health promotion has emerged as an approach that offers greater potential for change in the health-related behavior of populations than does health education (Green and Richard 1993; Downie et al. 1996; *Health Promotion International* 1997). Health promotion emphasizes social, economic, and other environmental influences as the primary determinants of health behavior change (WHO 1986; Downie et al. 1996; *Health Promotion International* 1997). Though such health promotion strategies have been characterized as a new approach to public health, ecological and policy-oriented approaches are similar to the public health methods of the latter part of the 19th century and the early decades of the 20th century (Kickbusch 1989; Green and Richard 1993; Mullan 2000). As the role of individual risk behaviors, such as tobacco use, was increasingly understood in the middle of the 20th century, individually focused educational strategies gained primacy (Green and Richard 1993). These strategies produced some important changes in health behaviors, but their limits were realized in the cardiovascular disease

prevention programs that took place in the United States during the 1970s and 1980s (see "Community Intervention Trials," later in this chapter) (Green and Richard 1993; Luepker 1994; Winkleby 1994; Fisher 1995; Schmid et al. 1995; Susser 1995).

The shift from a health education approach that targets the individual to a health promotion approach that uses social, policy, and environmental strategies has several advantages. First, by recognizing that many environmental determinants of health behavior are not under the direct control of the individual, the ecological focus avoids blaming persons who fail to modify their behavior. Second, many educational strategies are more effective with better-educated, wealthier persons and may thereby increase the disparities in health between population groups and fail to reach those in greatest need. Third, regulatory and policy interventions can be more cost-effective than multiple efforts to modify individual behavior.

Description of Comprehensive Programs

The importance of comprehensive economic, policy, and regulatory interventions to reduce tobacco use has long been recognized by international experts (WHO 1979). For example, the evolving WHO guidelines for such interventions have increasingly emphasized policy and legislative measures, stressing that these types of health promotion and health protection strategies are essential elements of any national effort to reduce tobacco use (WHO 1998). In an extension of the WHO's efforts, the National Cancer Institute (NCI) released a blueprint for related public health action in the United States (NCI 1991). This monograph stressed that the application of social environmental approaches should not compete with individual approaches but should be combined synergistically with them. Similarly, the Center for Substance Abuse Prevention (CSAP) of the Substance Abuse and Mental Health Services Administration (SAMHSA) published guidelines that provide the concept, structure, and operations of a community-based approach to reduce tobacco use among youth (SAMHSA 1998a,b). To further help states overcome common obstacles to enforcing youth access laws, CSAP also has provided a document that provides strategies to address problems such as interagency and intraagency issues, insufficient or uncoordinated resources, or lack of data sources (U.S. Department of Health and Human Services [USDHHS] 1999). More recently, the CDC (1999a) has synthesized a comprehensive framework for statewide programs to reduce tobacco use. This framework integrates four program goals with four program components; optimally, each of the goals would be fully addressed in the implementation of each of the components. The framework, described in the next section of this chapter, recognizes that comprehensive programs will continue to evolve, in response both to new information and to new circumstances. In addition, the framework represents a distillation of evidence and judgment that have been discussed in detail in the earlier chapters of this report and that have been tested in the community-based trials and the comprehensive programs discussed later in this chapter.

Program Goals for Reducing Tobacco Use Statewide

1. ***Prevent initiation among young people.*** The hallmarks of this goal are

   - Decreasing young people's access to tobacco products.
   - Increasing prohealth messages.
   - Reducing protobacco messages.
   - Increasing the price of tobacco products.

   Some of the mechanisms for decreasing young people's susceptibility to tobacco use are promoting youth empowerment activities, providing school health education, offering positive alternatives, deglamorizing tobacco use, and involving parents and families.

2. ***Promote quitting among adults and young people.*** An environment that supports efforts to quit using tobacco can be fostered by

   - Increasing access to culturally appropriate, effective cessation services (e.g., by expanding insurance coverage).
   - Increasing the price of tobacco products.
   - Increasing restrictions on environmental tobacco smoke (ETS).

- Increasing prohealth messages.
- Decreasing protobacco messages.

3. *Eliminate exposure to ETS.* The continued expansion of policies to eliminate exposure to ETS can be achieved by

   - Developing support for implementation.
   - Enforcing voluntary private policies.
   - Enforcing public policy and public regulation.
   - Expanding coverage of public areas.

4. *Identify and eliminate disparities among population groups.* Intrinsically linked to achieving the first three goals, eliminating disparities entails

   - Increasing the price of tobacco products through culturally acceptable programs.
   - Decreasing exposure to ETS.
   - Increasing prohealth messages.
   - Decreasing protobacco messages, particularly those aimed at population subgroups.
   - Increasing the availability of culturally acceptable cessation services.
   - Increasing protective factors among young people.
   - Decreasing young people's access to tobacco products.

Development, funding, and implementation of the major elements—some of which appear in several of these goals—are critically linked to community involvement and, as noted, to a culturally appropriate approach.

Program Components for Reducing Tobacco Use Statewide

1. *Community interventions.* Working through social organizations, systems, and networks promotes an environment that facilitates individual health choices and establishes freedom from tobacco use as the norm. The term "community" encompasses a diverse set of entities, including medical societies; schools; school districts; departments of education; voluntary health agencies; civic, social, and recreational organizations; businesses and business associations; city and county governments; public health organizations; labor groups; managed care systems; faith communities; and organizations for racial and ethnic minority groups.

   Community-based activities can include supporting legislated removal or restriction of stimuli to use tobacco (such as advertising and promotion, easy access to tobacco products via self-service display and vending machines, and ongoing exposure to ETS) as well as providing positive alternatives (such as promoting cessation, encouraging prevention advocacy, developing role modeling through parents and adults, and fostering youth empowerment). By changing the community setting and institutions with which adults and young people interact, community-based activities work to denormalize, deglamorize, and discourage tobacco use and to provide access to resources that increase users' ability to control their addiction and use of tobacco. This approach has the potential to effect substantial, sustained, populationwide change in tobacco use behavior.

2. *Countermarketing.* Changing a social environment that fosters a norm of tobacco use is an essential element of national, state, and local programs. This change requires strategies to counter the billions of dollars spent in advertising and promotion that reach young people and adults with misleading images about tobacco. Countermarketing efforts can include using media advocacy, paid media, and counteradvertising; increasing prohealth promotions and sponsorships; and providing information on the tobacco industry's marketing and promotional tactics. These public health messages should use a strategy that targets all age groups and populations. In a comprehensive strategy, education messages will be mutually reinforcing: clean indoor air messages will provide added motivation for adults to quit smoking; cessation messages for adults will discourage tobacco use among young people and accentuate the problem of addiction; and youth prevention messages will increase the salience of the tobacco issue among parents and community leaders.

3. *Program policy and regulation.* Areas in which policy and regulation to reduce tobacco use have been applied include minors' access, tobacco pricing, advertising and promotion, clean indoor air, product regulation, product labeling, ingredient disclosure, and policies on insurance coverage for cessation services. Policies and regulations can be established at the federal, state, and local levels (see Chapter 5). Ideally, policies and regulations need to be implemented at both the community level and statewide. Educating the public about policies and regulation is crucial to acceptance, but such education must be supported by adequate enforcement.

4. ***Surveillance and evaluation.*** Surveillance and evaluation efforts are necessary to make the ongoing refinements that lead to more effective prevention strategies. In addition to traditional surveillance methods, nontraditional approaches—such as monitoring the promotional activity of the tobacco industry at the state and local levels, monitoring the economic impact of smoking laws and other ETS policies, and performing periodic surveys of public opinion on program interventions—are critical for reducing tobacco use.

The conceptual framework for comprehensive efforts to reduce tobacco use has been used to develop the current generation of statewide programs. However, even the most comprehensive programs currently in place have not been able to fully implement all recommended components. Policy and regulation components are especially hampered, since many state and local actions are limited by federal mandates and preemptions (see "Preemption of Local Action by State Policy" in Chapter 5). Moreover, only two states, California and Massachusetts, have implemented comprehensive programs for a sufficient time to provide evaluation data on the overall efficacy of the emerging comprehensive model.

The following sections summarize the history and development of community-based, statewide, and other large-scale efforts to reduce tobacco use and conclude with a review of existing data on the efficacy of the comprehensive model.

Community Intervention Trials

Large-scale trials to prevent cardiovascular disease have been a major source of data on population-based approaches to reducing tobacco use. An emphasis on the importance of addressing social and cultural determinants of smoking behavior grew directly out of early work on cardiovascular disease epidemiology. The Seven Countries Study, which was started in the mid-1950s by Keys and colleagues (Aravanis et al. 1970; Blackburn et al. 1970; Buzina et al. 1970; Fidanza et al. 1970; Kimura and Keys 1970; Taylor et al. 1970a,b), examined risk factors for cardiovascular disease in populations around the world and documented that disease rates and risk factors differed markedly across cultural and social environments (WHO 1982). In that study, more than 12,500 men aged 40–59 years from Finland, Greece, Italy, Japan, the Netherlands, the United States, and Yugoslavia were recruited for a prospective study of the relationship between personal behaviors (e.g., diet, physical activity, smoking) and risk of cardiovascular disease (Aravanis et al. 1970; Blackburn et al. 1970; Buzina et al. 1970; Fidanza et al. 1970; Kimura and Keys 1970; Taylor et al. 1970a,b). Although the most striking differences in lifestyle across cultures were in the composition of the men's diet, smoking was found to be a significant risk factor. This study, and many other early studies of cardiovascular disease epidemiology, encouraged researchers to start community trials to modify the identified risk factors in whole population groups (WHO 1982).

Two landmark community trials that began in 1972 grew directly out of the work of the Seven Countries Study investigators: the Stanford Three-Community Study (Farquhar et al. 1977) and the Finnish North Karelia Study (Puska et al. 1985). A third, less directly tied to this early work, was the Israeli Community Syndrome of Hypertension, Atherosclerosis and Diabetes (CHAD) program (Gofin et al. 1986) begun in 1971. In addition, two worksite trials focusing on population-level changes in cardiovascular disease risk factors developed out of the Seven Countries Study and from related early work on cardiovascular disease epidemiology: the Belgian Heart Disease Prevention Project (Kornitzer et al. 1980) and the United Kingdom Heart Disease Prevention Project (Rose et al. 1980). Though investigators in these initial studies recognized the importance of the social and cultural environment in modifying risk factors for cardiovascular disease, including smoking (Farquhar 1978; WHO 1979; Farquhar et al. 1981, 1985; Rose 1981; McAlister et al. 1982; Puska et al. 1985), the smoking cessation techniques of the time were primarily individually oriented (McAlister et al. 1976; Meyer et al. 1980).

The Stanford and North Karelia studies shared some community organizing and conceptual perspectives in their planning (WHO 1982). Logistical and cultural differences between the United States and Finland dictated significantly different implementation, however. In the Stanford study, an intervention that

primarily used mass media was compared with the same mass media intervention plus intensive face-to-face counseling for high-risk individuals and was also compared with a control community that received no intervention. In the initial results, the community cohort receiving both the mass media and the face-to-face counseling for high-risk smokers had a significantly greater decrease than the control community in the prevalence of smoking (–50 vs. –14.9 percent) and in the number of cigarettes smoked (percentage reduction of 51.6 vs. 21.0 percent) (Farquhar et al. 1977, 1985; Maccoby et al. 1977; Meyer et al. 1980).

In the Finnish study, the people of North Karelia province requested the intervention because of concerns raised by the results of the Seven Countries Study, in which residents of their province had participated (Puska et al. 1985, 1995). The intervention had a strong focus on community organizing and environmental modification, together with multiple educational components using mass media and other strategies (McAlister et al. 1982; Puska et al. 1985). Although the intervention's early efforts had a greater emphasis on increasing direct cessation services than on preventing smoking, the importance of nonsmoking environments and other environmental changes was clearly recognized and emphasized (Koskela 1981). The five-year follow-up results of the study found no significant difference in smoking prevalence between the North Karelia province and Kuopio, a comparison province with similar baseline smoking rates (Puska et al. 1979). Ten years on, a significantly greater reduction in smoking prevalence was observed among men in North Karelia than in Kuopio (Salonen et al. 1981; Puska et al. 1983a,b; Vartiainen et al. 1986). The intervention trial has been continued, and new prevention and population-based cessation strategies have been added (Vartiainen et al. 1986; Korhonen et al. 1992, 1993). Analyses of 20-year trends (from 1972 to 1992) in smoking in the two provinces found a significantly greater decline in smoking prevalence for adult men in North Karelia (from 52 to 32 percent) than in Kuopio (50 to 37 percent) and in southwestern Finland. Smoking prevalence for adult women increased at similar rates in both provinces (increasing from 10 to 17 percent in North Karelia and from 11 to 19 percent in Kuopio) (Vartiainen et al. 1998). The 20-year difference in trends in men between the two provinces appeared to be primarily related to cessation during the first 10 years and to prevention during the last 10 years.

The CHAD program had a somewhat more individually focused intervention model directed at reducing the risk factors for cardiovascular disease among residents in Israeli housing projects (Abramson et al. 1981). The health care providers serving the intervention communities provided risk factor screening and counseling for families, couples, and individuals living in the four adjacent housing projects. The residents of comparison housing areas received usual care from their providers. In the intervention communities, group discussions were held to provide social support and increase group influences on individual lifestyle changes. Comparisons between community health surveys conducted at baseline (1969–1971) and after five years (1975–1976) showed a significantly greater decline in smoking prevalence among men but not among women in the intervention communities than in control communities (Gofin et al. 1986). At the 10-year follow-up (1981), the prevalence of smoking had declined significantly between 1976 and 1981 among both men and women in the CHAD follow-up cohort, whereas no change or a slight increase in smoking had occurred among adults in Israel overall (Gofin et al. 1986).

The Belgian Heart Disease Prevention Project was a controlled, multifactorial trial involving men aged 40–59 years at baseline at Belgian worksites (Kornitzer et al. 1980). Thirty pairs of factories were studied, with one site from each pair randomly assigned to the intervention group and one site to the control group. At baseline screenings for risk factors for cardiovascular disease, individuals in the upper two deciles of risk were identified and received semiannual individual counseling from the medical staff. Medical advice to quit smoking was reinforced in the factories by antismoking posters, written messages, and health education conferences encouraging workers to quit smoking and to encourage the same to their friends who smoked. Changes in smoking prevalence at the intervention and control worksites were monitored among both the high-risk individuals and in random samples of the total worksite populations. After two years of intervention, a significantly greater percentage of the high-risk smokers quit in the intervention group than in the control group (18.7 vs. 12.2 percent), but no difference was observed in the random samples.

The United Kingdom Heart Disease Prevention Project was started in 1971 with 24 pairs of English and Welsh factories. Each member of the pair was randomly assigned to intervention or control status (Rose et al. 1980; Bauer et al. 1985). At baseline and in 1977–1978, risk factor screening for cardiovascular disease was conducted among men aged 40–59 years in the intervention sites and in a 10-percent random sample of similarly aged men at the control sites. Over a five- to six-year period, all men in the intervention sites